REMARKS

The Examiner has rejected existing claims 1, 4, 6-7, 11-14, 16-21, 27, 34-35, 38-44 as being anticipated by Jacquemet.

The Examiner is referred to the website:
http://en.wikipedia.org/wiki/Linear_induction_motor
as an indication of the functionality of a Linear induction Motor (LIM). In LIM's, a force is produced on a conductor such as LIM reaction member by a moving linear magnetic field acting on the reaction member.

A reaction member that is placed in this moving linear magnetic field will have eddy currents induced in it, thus creating an opposing magnetic field. The two opposing fields will repel each other, thus forcing the conductor away from the stator and carrying it along in the direction of the moving magnetic field.

This explanation must be compared to the apparatus of Jacquemet, which is not a LIM, as it does not include a moving magnetic field. This apparatus uses a circuit driving an electromagnet (not a LIM) to move a core 1 upwardly. Once energised, the electromagnet 2 pulls the core 1 upward until it is centralized against the electromagnet 2. Once the core has been raised upwardly, the circuit is cut and the electromagnet 2 is stopped. The core 1 is then accelerated by gravity (at G m/s^2) to impact on a pile.

The impact of the core on the pile will be proportional to its kinetic energy E_k at impact. This is because the kinetic energy of the core is transferred to the pile on impact. The kinetic energy E_k of the core is proportional to its mass m and velocity v at impact as:

$$E_k=mv^2$$

The velocity v of the mass m will in turn be proportional to the

distance that it has accelerated at acceleration a under Toricelli's equation for constant acceleration:

$$v^2 = u^2 + 2a^* \Delta x$$

where u= initial velocity

a= acceleration

Δx = change in distance (which in this case will be the height of the drop of the core) as the core starts from rest

U=0, and

a=G (the gravitational constant) = $9.81 m/s^2$

we have

$$v^2 = 2G^* \Delta x$$

So:

$$E_k = m\ v^2 = m^*\ 2G^* \Delta x$$

For constant acceleration, the kinetic energy E_k is proportional to the mass m, gravitational acceleration G and the distance over which the acceleration occurred Δx (which will correspond to the height from which the mass m was dropped). The apparatus described in Jacquemet is limited by these variables m, G, and Δx.

The functionality of this apparatus is completely different from that of the present invention in that the present invention uses a LIM to accelerate the LIM reaction member and ram in BOTH directions (i.e. to raise the ram against the acceleration due to gravity as well as to accelerate the ram downwardly) substantially throughout the length of movement of the ram. Jacquemet merely uses a stationary electromagnetic field of an electromagnet to raise the core to a required potential energy. No increase of the kinetic energy of the ram to provide

increased pile driving ability is disclosed or suggested. The new claims include the requirement that the reaction member be accelerable in both directions, and substantially along their length of movement of the reaction member.

The present invention functions similarly to the Jacquemet apparatus in raising the ram to a particular height (although by a differing magnetic drive process) to provide it with a distance Δx over which the mass m of the ram and reaction member can be accelerated.

However, when the ram and reaction member (having mass m) is accelerated over Δx on the down stroke, the LIM provides an additional force on the mass, thereby accelerating it at an acceleration greater than gravity G.

The electromagnetic force exerted by the LIM on the mass m to accelerate it by acceleration a is:

$$F=m.a$$

and the acceleration is thus

$$a= F/m$$

The Kinetic energy provided by the current invention (for a constant acceleration a) will hence be

$$E_k=m\ v^2= m^*\ 2(G+a)^*\Delta x$$

As may be seen from row 5 in Table 2 in the specification, acceleration a may be up to 9.5 times greater than G, which means that the mass m will be accelerated to a greater velocity and result in a proportionally higher kinetic energy. For the greatest kinetic energy, it is preferably that the ram will be accelerated substantially throughout its travel to the greatest possible velocity.

In the present invention, to obtain the same kinetic energy (by imparting a greater acceleration), a smaller mass can be used than traditionally

used in pile drivers which rely on smaller acceleration imparted to a heavier mass for their kinetic energy.

A comparison can be made of the 200kg falling masses required by the prior art (shown in row 1 of Table 1 in the specification) compared to the 25/30kg mass required by the invention (as shown in row 2 of Table 2) to obtain similar kinetic energies (shown in row 1 of Table 1 and Table 2).

Furthermore, and as explained before in the applicant's reply to the first Office Action, the present invention can provide a negative acceleration (-a, so that the resultant acceleration is (G-a)), to reduce the kinetic energy of the mass for more fragile situations where the integrity of surrounding areas is to be maintained. This is an additional advantage offered by the current invention, but not its main inventive aspect.

Also, as explained in the applicant's reply to the first Office Action, this artificial acceleration imparted to the mass m can be used to drive elongate members in non-vertical or even horizontal alignments. However, while this feature is an added benefit, it is not the main inventive aspect.

For the above reasons, the apparatus shown in Jacquemet cannot be said to be a LIM, as it does not utilize a moving electromagnetic field, and does not accelerate a reaction member substantially along the length of the LIM, which is why it does not function at all like the current invention. Nor does it provide the benefits an/or advantages of the current invention, including:

1. utilizing a much smaller mass to provide a similar kinetic energy, alternatively use the same mass to provide increased (or decreased) kinetic energy

2. being able to control the precise rate of acceleration and travel of the ram

3. being able to operate at angles out of the vertical, and even horizontally

4. being able to extract an elongate member in a similar fashion as described above.

In particular, Jacquemet does not include the features as shown in the new claims:

1. A LIM for accelerating the reaction member in a reciprocating fashion "from a retracted position to an impact position, and from the impact position to the retracted position".

2. Acceleration of the core "substantially along the length of movement "of the core during movement of the core from its retracted position to its impact position. The electromagnet of Jacquemet only moves the core from an impact position to a retracted position.

3. The concept of increasing the kinetic energy of the core by increased acceleration of the core along the length of the LIM to increase the force imparted to a pile.

The current invention's inventiveness relies on the idea that the kinetic energy of the ram is increased without resorting to heavier rams or increased lifting height, but by increased acceleration and hence increased velocity.

Jacquemet does not recognize the benefits to be had from increasing the acceleration of the core by electromagnetic means, nor does it describe any

problems associated with lack of velocity or low kinetic energy of the core, nor propose solutions thereto.

For the above reasons, applicant believes that the present invention is novel and inventive over the cited reference Jacquemet.

Applicant believes that since claim 45 has been shown to be novel and inventive over Jacquemet, then dependent claims 46-79 will be rendered novel and inventive by virtue of them being dependent on novel and inventive independent claim 45.

US Pat. No. 4,390,307 (Rice)

Rice describes a pile driving apparatus for driving metallic piles into the seabed using a linear induction motor (LIM). Linear induction motors have been known since 1905 (as described in US patent 782312) as a means to move metallic objects with a powerful electromagnetic force.

Rice uses a LIM's linear force capacity to directly drive the metallic pile into the seabed. This invention would most likely be used in conjunction with a turning mechanism to cut its way into hard rock. This mechanism does not provide an impact force onto the pile itself, and would rely completely on the force from the LIM, together with any cutting/turning/boring action on the pile itself.

This apparatus further has obvious disadvantages in that only metallic piles can be driven. Conceptually, as described with reference to Jacquemet, Rice also does not describe the use of increased acceleration of a ram (or the pile) to increase the kinetic energy of the ram or pile. No suggestion is put forward in Rice that the capacity of the LIM to drive the pile may be made more effective by

increasing the kinetic energy of a ram, to then impart this kinetic energy to a pile by an impact or impulse.

While LIM's can be powerful, they are generally not powerful enough (without being very large and expensive) to be able to just push a pile into rock directly. Similarly, a large expensive LIM would be required to move a typical pile driver mass of 200kg against the force of gravity. The use of LIM's in pile drivers were not seen as an alternative to gravity accelerated large masses, since they were not powerful enough to push directly through rock, and cheaper means (such as normal electromagnets) could be used to move a large weight to the top of a typical pile driver.

Applicant respectfully submits that without introducing the inventive step of using a LIM to accelerate a relatively lightweight ram to provide similar kinetic energy values as larger masses by increased acceleration of the ram on the downstroke of the ram, it would not have been obvious for a person skilled in the art to assume that a LIM could be used in reciprocating mass pile driving.

US Pat. No. 4,844,661 (Martin)

This publication discloses an apparatus which uses an electromagnet in a similar way to Jacquemet. That is, to move the heavy weight to the top of the chasis for subsequent acceleration by gravity to impact on a pile. The apparatus of Martin includes a polarity inverter mechanism that causes a single repulsive force to be induced by the electromagnet 2 against the hammer 3 to push it momentarily downwards.

While this apparatus does increase the kinetic energy of the hammer fractionally as a once off, this publication does not suggest or teach the

acceleration of smaller mass hammers throughout the downstroke to substantially increase their kinetic energy. Again, applicant respectfully submits that even when seen in combination with Rice above, an inventive step would be required by a person skilled in the art to make a connection between the use of LIM's and normal pile driving to come up with this inventive concept.

US Pat. No. 4,124,081 (Deike)

Deike discloses a known hydraulically powered post driving machine mounted to a vehicle for increased mobility. As explained above, known kinetic energy-type post driving machines utilize a heavy mass which is accelerated by gravity. The use of a heavy mass is inherently undesirable in mobile post driving machine. This is because the haulage of heavy mass is expensive on the vehicle and results in increased wear of the vehicle components. The increased mass also makes the vehicles less fuel efficient.

Further, problems are encountered when the post driving machine must be suspended off the side of the vehicle. Where the post driving machine is heavy, a large vehicle is required to provide stability to hold the machine off the side of it. Alternately, bracing struts are required, which take time and energy to set up, and increase the cost of the machine.

A hydraulically powered post driving machine allows less mass to be suspended off the side of the vehicle when post driving, however, hydraulically powered post drivers are heavy in that they require an associated compressor or compression system. Further, hydraulically powered machines require regular servicing and maintenance due to the high pressures that are part of their daily operation, and typically involve many moving parts, which typically allows for more operational failures.

By comparison, a system according to the invention, having a LIM driven post driving machine mounted to a vehicle, has relatively few moving parts, is light, and can be mounted off the side of the vehicle with reduced stability problems.

Clearly the use of the Jacquemet, Martin or Rice apparatus with the Deike apparatus will still not offer the synergies and benefits of the current invention. The synergies found from the use of the current invention on a vehicle are directly related to the use of high velocity to increase kinetic energy instead of high mass. Jacquemet and Martin still utilize the heavy masses necessary for their system, while Rice does not use the high energy transfer of an impact to drive the pile, and will not be as effective or useful as the current invention.

Deike is silent on the use of high velocity to increase kinetic energy. No mention is made of the recognition of the problem of reducing the weight of the post driving machine, much less by using a smaller mass accelerated artificially by a LIM to a higher velocity.

Applicant believes that the above explanations differentiate the current invention from those apparatuses cited in the publications, both in terms of novelty and inventiveness. In addition to this, the present invention offers additional advantages in that it may be used in a horizontal plane, and can be controlled to a particular speed. None of these additional benefits or advantages are offered by the prior art.

Based on the foregoing amendments and remarks, it is respectfully submitted that the present application should now be in condition for allowance. A Notice of Allowance is in order, and such favorable action and reconsideration are respectfully requested.

However, if after reviewing the above amendments and remarks, the Examiner has any questions or comments, she is cordially invited to contact the undersigned attorneys.

Respectfully submitted,

JACOBSON HOLMAN PLLC

By: _____
John C. Holman
Reg. No. 22,769

400 Seventh Street, N.W.
Washington, D.C. 20004-2201
(202) 638-6666
Date: July 22, 2009
JCH/JLS:yb